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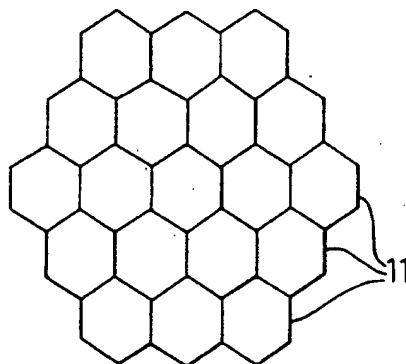
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(56) Documents Cited  
**JP 080116093 A**      **US 4857801 A**      **US 4845405 A**  
**US 3872463 A**

(58) Field of Search  
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**ON LINE, W.P.I.**

(54) Abstract Title  
**Assemblies of light emitting diodes**

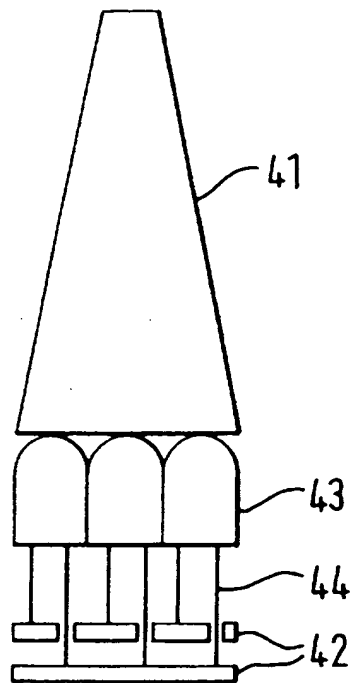
(57) A light emitting diode 11 is formed with faces which are complementary to the faces of surrounding light emitting diodes. The assembly of light emitting diodes may be used to harden dental polymers or in cancer therapy.



**FIG.1**

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FIG. 4



Thus the LEDs occupy more of the available space, and a fixed number produce a higher radiant intensity. Thus, smaller numbers of LEDs can be used to produce a desired level of irradiance, which in turn reduces the power required to drive the device and the heat generated by it. Furthermore, the device can be made more compact.

Typically, a central LED might have a polygonal outer surface, and a first ring of LEDs would be arranged around it, each with a flat face to abut a corresponding face of the central LED and possibly each having a pair of radiating side faces which abut adjacent LEDs in the first ring. Furthermore, a second or more rings of LEDs could be arranged concentrically with the first ring, each with respective adjacent flat side faces abutting one another and possibly with inwardly diverted faces abutting respective outwardly directed faces of the LEDs of the first ring.

In one embodiment of the invention shown in Figure 1 hexagonal LEDs 11, may be clustered in the manner of a honeycomb. In a second embodiment of the invention shown in Figure 2, a central hexagonal LED 21 may abut flat faces of six LEDs 22 in a first ring contained within a second ring of LEDs 23 with radiating side faces that allow adjacent LEDs in the second ring to abut one another. In a third embodiment of the invention shown in Figure 3, an inner ring of nine LEDs 31 in a first ring is contained within a second ring of LEDs 32 with radiating side faces that allow adjacent LEDs in the second ring to abut one another. In both the second and third embodiments, the adjacent faces of the LEDs of the first and second ring may also be shaped to abut one another. It will be appreciated in all three embodiments, the LEDs are mounted in a substantially flat plane.

beneficial effect on illuminance and increasing detrimental effect on compactness, heat generation and cost.

In a preferred embodiment of the invention, a single tapered light guide 41 is provided, as shown in Figure 4. If required the light guide can be curved along its length to direct the output beam to suit a particular application, this being a known practice with existing light guides. The light guide may be machined from cast acrylic plastic and bent, or could be made from glass or other optically transparent materials.

It will be appreciated that the irradiance of a device according to the invention can be varied by varying the input power, number of the LEDs, or by varying the adiabatic taper of the light guide.

In alternative embodiments of the invention, instead of providing a single tapered light guide, each LED or groups of LEDs could be provided with its own light guide fibre incorporating an adiabatic optical taper and the output ends of these fibres can be collected together to form a single output beam. The input end of the fibre would be moulded optically to the adjacent LED or group of LEDs for efficient transmission of radiation. In yet another embodiment of the invention, each LED could be adjusted so that its outer envelope is extended into a fibre light guide which incorporates an adiabatic optical taper.

Cooling of the LED cluster is aided by arranging that the electrical connections 44 of each LED 43 are connected to heat sinks as shown in Figure 4, which are thermally

## CLAIMS

1. An optical irradiation device comprising a cluster of light emitting diodes, in which opposing faces on adjacent light emitting diodes are shaped to complement one another.
2. An optical irradiation device as claimed in claim 1, wherein the cluster of light emitting diodes is arranged to increase the ratio of occupied to unoccupied space in the cluster.
3. An optical irradiation device as claimed in claim 1 or claim 2, wherein the cluster is arranged radially.
4. An optical irradiation device as claimed in claim 1, claim 2, or claim 3, wherein the cluster includes a first ring of light emitting diodes.
5. An optical irradiation device as claimed in claim 4, wherein the first ring of light emitting diodes is arranged around a central light emitting diode.
6. An optical irradiation device as claimed in claim 5, wherein the cluster includes a second ring of light emitting diodes arranged around the first ring.
7. An optical irradiation device as claimed in any one of the preceding claims, wherein the opposing faces on an adjacent pair of light emitting diodes are flattened.



Application No: GB 9720443.2  
Claims searched: All

Examiner: C.D.Stone  
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**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.P): H1K(KPADL,KEAP)

Int CI (Ed.6): H01L

Other: ON LINE, W.P.I.

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	US 4857801 LITTON SYSTEMS	1,12 at least
X	US 4845405 SANYO	1,12 at least
X	US 3872463 LAPEYRE ( See col.2 lines 27-31 and col.3 lines 44-47)	1,12 at least
X	JP 08 0116093 FUJITSU	1,12 at least

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X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.